

Surveillance Data from *Salmonellae* Isolated from Pigs in Great Britain over a 10 year period (1991 to 2000).

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Summary: Isolates from a total of 3170 incidents of *Salmonella* from pigs were serotyped during the period 1991-2000; 4443 isolates were tested against 16 antimicrobial agents to produce resistance profiles. Of these isolates the predominant serovar appears to be *S. Typhimurium*; *S. Derby*, *S. Goldcoast* and *S. Panama* constituted the other serovars recorded as significant in incidents. During the study period both *S. Typhimurium* and *S. Derby* both show a trend towards an increase in resistance to tetracycline and compound sulphonamides. Also noted was a fall in sensitivity of the non-*Typhimurium* isolates to a range of commonly used antimicrobial agents, with an overall fall in sensitivity of 7% to 31% of strains being sensitive in 2000.

Keywords: Antimicrobial resistance, *Salmonella*, human disease.

Introduction: This study addressed the trends of antimicrobial-resistant *Salmonella* emerging in pigs, based on surveillance data for 1991 – 2000. Additionally the study sought to place the veterinary data in context of the corresponding human disease arising from pigmeat outbreaks. Currently, the total number of human disease cases as a consequence of pigmeat outbreaks between 1992-1999 was 783 (PHLS, 2001).

Materials and Methods: *Salmonella* cultures: A total of 5089 cultures of *Salmonella* submitted from 3170 recorded incidents, were received from the Veterinary Regional Laboratories in England and Wales during the period 1991-2000, were serotyped using a microtitre method based on the CPHL method (Shipp and Rowe, 1980). These *Salmonella* cultures (n=4443), were tested against 16 antimicrobial compounds. *Sensitivity tests:* A disk diffusion technique using Sensitest agar (Oxoid) and antimicrobial containing disks (Oxoid) was used (Wray *et al.*, 1991). The disks contained the following antimicrobials: Amikacin (30µg) AK; Amoxycillin/clavulanic acid (30µg) AMC; Ampicillin, A (10µg); Apramycin, APR (15µg); Cefoperazone, CF (30µg); Cefuroxime, CX (30µg); Chloramphenicol, C

(10µg); Chlortetracycline, T (10µg); Colistin, CT (25µ) Furazolidone, FR (15µg); Gentamicin, G (10µg); Nalidixic Acid, NA (30µg); Neomycin, N (10µg); Streptomycin, S (25µg); Sulphamethoxazole/trimethoprim, TM (25µg); Sulphonamide compounds, S3 (500µg, from 1998 onwards 300µg was used). A growth inhibition zone diameter of less than 13mm was recorded as resistant (Sojka *et al.*, 1972).

Results: 1. *Serotype prevalence isolated from porcines 1991-2000.*

Salmonella Typhimurium was the most predominant serotype isolated from porcines during the 10 year study period, constituting between 60 % (1993) and 74 % (2000) of incidents. *Salmonella* Derby was found to be the next most commonly isolated serotype, contributing up to 15 % of incidents over the study period. *S. Kedougou*, *S. Gold coast*, *S. Panama* and *S. Manhattan* constituted the other major serotypes most prevalent from porcine submissions. Other *Salmonella* serotypes including *Agona*, *Anatum*, *Brandenburg*, *Bredeney*, *Choleraesuis*, *Choleraesuis* VK, *Dublin*, *Enteritidis*, *Give*, *Heidelberg*, *Infantis*, *Kimuenza*, *Livingstone*, *London*, *Mbandaka*, *Montevideo*, *Newport*, *Ohio*, *Poona*, *Reading*, 4,12:d.

2. *Salmonellae from porcines resistant to Tetracycline & compound sulphonamides (S3).*

Between 1991 and 2000 there was a marked decrease in antimicrobial susceptibility of *S. Typhimurium* isolated to compound sulphonamides (C3) with increasing resistance from 51 % in 1991 to 92 % in 1995. Subsequently resistance in *S. Typhimurium* has decreased slightly to 76 % in 2000. The Tetracycline resistance prevalence observed for *S. Typhimurium* appears to have sustained a consistently high trend with approximately 95 % of porcine isolates being recorded as resistant in 2000.

The corresponding resistance patterns recorded for *S. Derby* during the study period appear comparative to Tetracycline trends recorded for *S. Typhimurium*, with 100 % resistance recorded for 1995. *Salmonella* Derby sensitivity to compound sulphonamides (C3) fluctuated considerably over the study period with resistance levels increased from 33 % in 1991 to 66 % in 1995 and 1996. Latterly the resistance fell to 39 % in 2000.

3. *Antimicrobial resistance patterns of serotypes other than S. Typhimurium.*

The incidence of antimicrobial sensitivity for all *Salmonella* isolates excluding *S. Typhimurium* during the study period showed a rise in antimicrobial resistance; 48 % of isolates in 1991 were sensitive when tested against the antibiotic panel. In contrast, only 31 % of isolates were sensitive in 2000. However, the isolates in the

study were sensitive to the majority of antibiotics in the screening panel. A very low but detectable resistance to Naladixic acid has been observed since 1996. Increasing resistance trends to Tetracycline were demonstrated during the study period with figures doubling from 1991 to 2000. Similarly, resistance to compound sulphonamides increased from 33 % in 1991 to 58 % in 1998, latterly the % resistance decreased slightly to 37 % in 2000.

Discussion and Conclusions: The present findings infer that the overall picture of predominant *Salmonella* serotypes and resistance patterns remained consistent over the 10 year study period. However, the incidence of antibiotic resistant *S. Typhimurium* in pigs in Great Britain has been increasing despite a reduction in annual submissions. Within this study period the rise and subsequent fall of multi resistant *S. Typhimurium* DT104 was observed.

The presence of *Salmonella* Enterica serovars in livestock production is a major cause of foodborne disease in humans and it is recognised that pork can act as a vehicle for the transmission of *Salmonella* to humans (van Winsen *et al.*, 2001). The clinical picture in the United Kingdom between 1992 and 1999 indicated a total of 783 cases from 35 outbreaks, with *S. Typhimurium* as the prevalent *Salmonella* serotype. This serotype contributed to 13 outbreaks and 236 of reported cases of human illness and 2 deaths. *Salmonella* Enteritidis PT4 traced back to pigmeat accounted for 10 human outbreaks during the study period therefore cross-contamination of meat at retail level may also be involved. Pork and ham were the most common type of pigmeat to act as a vehicle for human infection between 1992 and 1999 (PHLS, 2001).

Several factors may contribute to the numbers and particular *Salmonella* serotypes prevalent within the pig industry. Pig farming inherently relies on large farm size; van Altrock *et al.* (2000) speculated that increases in the number of slaughtered pigs and supplying farms, may have given rise to an increase in the number of *Salmonella* positive carcasses samples during their study.

References:

- PHLS (2001) Data on outbreaks of Infectious Intestinal Disease linked with consumption of pigmeat 1992-1999. Personal communication.
- Shipp, C.R. B. Rowe (1980). A mechanised microtechnique for *Salmonella* serotyping. *Journal of Clinical Pathology* **33**, 595-602.
- Sojka W.J., G. Slavin, T.F. Brand, G. Davies (1972) A survey of drug resistance in *Salmonella* isolated from animals in England and Wales. *British Veterinary Journal* **128**: 189-198.

Von Altrock, A. Schutte, G. Hildebrandt (2000). Results of the German investigation in the EU Project "Salmonella in Pork (Salinork)"—2. Investigations in a slaughterhouse. Berl Munch Tierarztl Wochenschr **113**, 225-233.

van Winsen, R.L., A. van Nes, D. Keuzenkamp, H.A.P. Urlings, L.J.A. Lipman, S. Biesterveld, J.M.A. Snijders, J.H.M. Verheijden, F. van Knapen, (2001) Monitoring of transmission of *Salmonella enterica* serovars in pigs using bacteriological and serological detection methods. Veterinary Microbiology **80**, 267-274.

Wray C., Y.E. Beedell, I.M. McLaren (1991) A survey of antimicrobial resistance in salmonellae isolated from animals in England and Wales during 1984-1987. British Veterinary Journal **147**: 356-369.